

ANATOMICAL CONSIDERATIONS OF THE SECONDARY WOOD OF  
*SANTALUM FERNANDEZIANUM* F. PHIL. (SANTALACEAE), AN  
 EXTINCT SPECIES OF THE JUAN FERNANDEZ ISLANDS, CHILE

CONSIDERACIONES ANATOMICAS DEL LEÑO SECUNDARIO DE  
*SANTALUM FERNANDEZIANUM* F. PHIL. (SANTALACEAE), ESPECIE  
 EXTINTA DEL ARCHIPIELAGO DE JUAN FERNANDEZ, CHILE

Se hace un estudio del leño secundario de *Santalum fernandezianum*, especie endémica y extinta del archipiélago de Juan Fernández. El xilema secundario es de tipo leñoso difuso, los vasos y fibras están cubiertos con depósitos sólidos, los radios medulares son 1-2 seriados.

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The Juan Fernandez Archipelago is located in the Pacific Ocean 670 km west of Valparaiso, Chile. It consists of three small islands of volcanic origin: Robinson Crusoe, Santa Clara, and Alejandro Selkirk. The most important and complete studies of the flora of these islands have been realized by Johow (1896) and Skottsberg (1921, 1951, 1953, 1956). The native flora is represented by 210 vascular plant species, including 127 endemics (60.4 %) (Stuessy, 1995; Stuessy *et al.*, 1992; Valdebenito *et al.*, 1992).

Oceanic islands are fragile ecosystems, easily suffering changes in their floristic composition by competition from introduced allochthonous species and/or the direct influence of humans. The Juan Fernandez Archipelago has not been an exception to this rule: two species already are considered extinct—*Podophorus bromoides* (Poaceae) and *Santalum fernandezianum* (Santalaceae). In spite of repeated searches at the type localities and other known or probable locations, these species could not be relocated. It is highly probable that they do not exist anymore in their natural habitats (IUCN 1986). *Podophorus bromoides* (Poaceae) probably occurred in a very restricted area, in the place now occupied by the village of

San Juan Bautista. The second example, *Santalum fernandezianum*, represents a classic case of complete extinction of a species. This tragic event occurred during the last decades of the previous century due to intensive exploitation of this odoriferous tree.

The fragrant wood of *Santalum album* has been used in the Orient for several centuries for the manufacturing of lacquered boxes and other handicrafts. The last living specimen of *Santalum fernandezianum* disappeared only a few years before 1916 (Skottsberg, 1921). Remains of the fragrant wood can still be found by inhabitants of Mas a Tierra, who collect pieces of old stems in local ravines.

One of the last living specimens of *Santalum fernandezianum* was used by Johow (1896) for a complete description of the species. Kraus (1882) published some preliminary information on the xylem of *S. fernandezianum*. The purposes of this paper is give more information of the secondary wood of *Santalum fernandezianum*.

The wood sample was obtained from the University of Concepcion Herbarium (CONC): Masatierra, 30-I-1892, F. Johow s.n.

Wood sections and macerations were pre-

pared according to Schweingruber (1982). Transverse, radial and tangential sections were cut on a Jung Tetrander sliding microtome and stained with acuose Safranin 1%. Macerations were made following Franklin's technique (1946).

Photos and drawings were made using a light microscope (Zeiss) and for some detailed observations a scanning microscope (ETEC, type Autoscan) was used.

For the wood description the nomenclature of Carothie (1970) and Chattaway (1932) was followed.

ANATOMICAL DESCRIPTION OF THE XYLEM

The wood is diffuse-porous in transverse section. Vessels are cylindrical, covered with solid deposits, wide, with the terminal walls slightly inclined (Fig. 1), almost rectilinear, solitary, 350-75 x 120-40 µm, with simple perforation plates and turning out in thin prolongations on both extremes (Fig. 3), unequal, with bordered pits (Fig. 4). Numerous fibres, 960-500 x 35-15 µm, with very thick walls and a small lumen pointed or obtuse on both sides, covered with abundant solid deposits (Fig. 5). Vascular rays up to 1-2 seriated and 6-12 cells high, 150-25 x 35-10 µm, procumbent, narrow rays (Fig. 2).

Dimensions of the wood components (µm):

	Length ± SD	Width ± SD
Vessels	220 ± 60	85 ± 20
Fibres	690 ± 100	25 ± 5
Cells of the vascular ray	65 ± 25	20 ± 5

A very interesting point is that *Santalum* here investigated contain vessels and fibers covered with abundant solid deposits, which may be responsible for the characteristic fragrance of this genus. The oils of *Santalum* that produce these desirable fragrances are δ and β Santalol (Steglich *et al.*, 1997). These compounds are distilled from the roots and stems and used in the elaboration of soaps and creams. The "real Santalum-oil" is obtained from *S. album*, from sesquiterpene alcohols (Frohne & Jensen, 1979).

In India the wood of species of *Santalum* as well as essences derived from the wood are used in religious rituals and popular medicine such as a urinary tract antiseptic (Delaveau *et al.*, 1980).

According to Ody (1993), the essential oils of *S. album* have an antidepressive, antispasmodic, caminative, expectorant, sedative and tonic effect.

Essential oil of the secondary wood of *Santalum fernandezianum* was analyzed by GLC-MS. β-santalol and β-santalene were isolated, the latter is responsible for the fragrance of the wood and exhibits various biological activities (Hoeneisen *et al.*, 1998).

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FIGURES: 1. Radial xylem section of *Santalum fernandezianum*; 2. Tangential xylem section of *S. fernandezianum*; 3-4. Vessels of *S. fernandezianum*; 5. Fibres of *S. fernandezianum*.